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भूकृत्रिम — ज्योमैम्बरेन और संबंधित  
उत्पादों के सूचकांक पंचर प्रतिरोध की  
परीक्षण विधि

**Geosynthetics — Method of Test for  
Index Puncture Resistance of  
Geomembranes and Related  
Products**

ICS 59.080.70

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## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Geosynthetics Sectional Committee had been approved by the Textile Division Council.

In the preparation of this standard assistance has been drawn from ASTM D4833 – 07 ‘Standard test method for index puncture resistance of geomembranes and related products’, issued by the American Society for Testing and Materials, USA.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## *Indian Standard*

# GEOSYNTHETICS — METHOD OF TEST FOR INDEX PUNCTURE RESISTANCE OF GEOMEMBRANES AND RELATED PRODUCTS

## 1 SCOPE

**1.1** This test method is used to measure the index puncture resistance of geomembranes and related products.

## 2 REFERENCES

The following standards and special publication are necessary adjuncts to this standard.

| <i>IS No.</i>         | <i>Title</i>                                                                       |
|-----------------------|------------------------------------------------------------------------------------|
| 6359 : 1971           | Method for conditioning of textiles                                                |
| 13321 (Part 1) : 1992 | Glossary of terms for geosynthetics: Part 1 Terms used in materials and properties |
| SP 45 : 2014          | Handbook on glossary of textile terms                                              |

## 3 TERMINOLOGY

For the purpose of this standard the following definitions and those given in SP 45 and IS13321 (Part 1) shall apply.

**3.1 Atmosphere for Testing Geomembranes** — Air maintained at a relative humidity  $65 \pm 2$  percent and a temperature of  $27 \pm 2^\circ\text{C}$ .

NOTE — Any other atmosphere for testing may be used as per the agreement between the concerned parties.

**3.2 Geomembrane** — A very low permeability synthetic membrane liners or barriers used with any geotechnical engineering related material so as to control fluid migration in a man-made project, structure, or system.

**3.3 Index Test** — A test procedure which may contain a known bias but which may be used to establish an order for a set of specimens with respect to the property of interest.

**3.4 Puncture Resistance (F)** — The inherent resisting mechanism of the test specimen to the failure by a penetrating or puncturing object.

## 4 PRINCIPLE

A test specimen is clamped without tension between circular plates of a ring clamp attachment secured in a tensile testing machine. A force is exerted against the

center of the unsupported portion of the test specimen by a solid steel rod attached to the load indicator until rupture of the specimen occurs. The maximum force recorded is the value of puncture resistance of the specimen.

## 5 APPARATUS

**5.1 Tensile/Compression Testing Machine**, of the constant rate-of-extension (CRE) type, with autographic recorder.

**5.2 Ring Clamp Attachment**, consisting of concentric plates with an open internal diameter of  $45 \pm 0.025$  mm, capable of clamping the test specimen without slippage. A suggested clamping arrangement is shown in Fig. 1. The external diameter is to be a minimum of 100 mm. The diameter of the six holes used for securing the ring clamp assembly is suggested to be 8 mm and equally spaced at a radius of 37 mm. The surfaces of these plates can consist of grooves with O-rings or coarse sandpaper bonded onto opposing surfaces.

**5.3 Solid Steel Rod**, with a diameter of  $8 \pm 0.1$  mm having a flat end with a  $45^\circ \times 0.8$  mm chamfered edge contacting the test specimen's surface (*see* Fig. 2).

## 6 SAMPLING

### 6.1 Laboratory Sample

Take for a laboratory sample extending the full width and of sufficient length along the selvage from each sample roll so that the requirement of 6.2 can be met. Take a sample that shall exclude material from the outer wrap and inner wrap around the core unless the sample is taken at the production site, then inner and outer wrap material may be used.

### 6.2 Test Specimens

From the laboratory sample, take fixed numbers of 5 specimens. Minimum specimen diameter is 100 mm sufficient to clamp in ring clamp attachment or sufficient to clamp in pneumatic apparatus.

## 7 PREPARATION OF TEST SPECIMENS

**7.1** Cut circular test specimens of 100 mm diameter

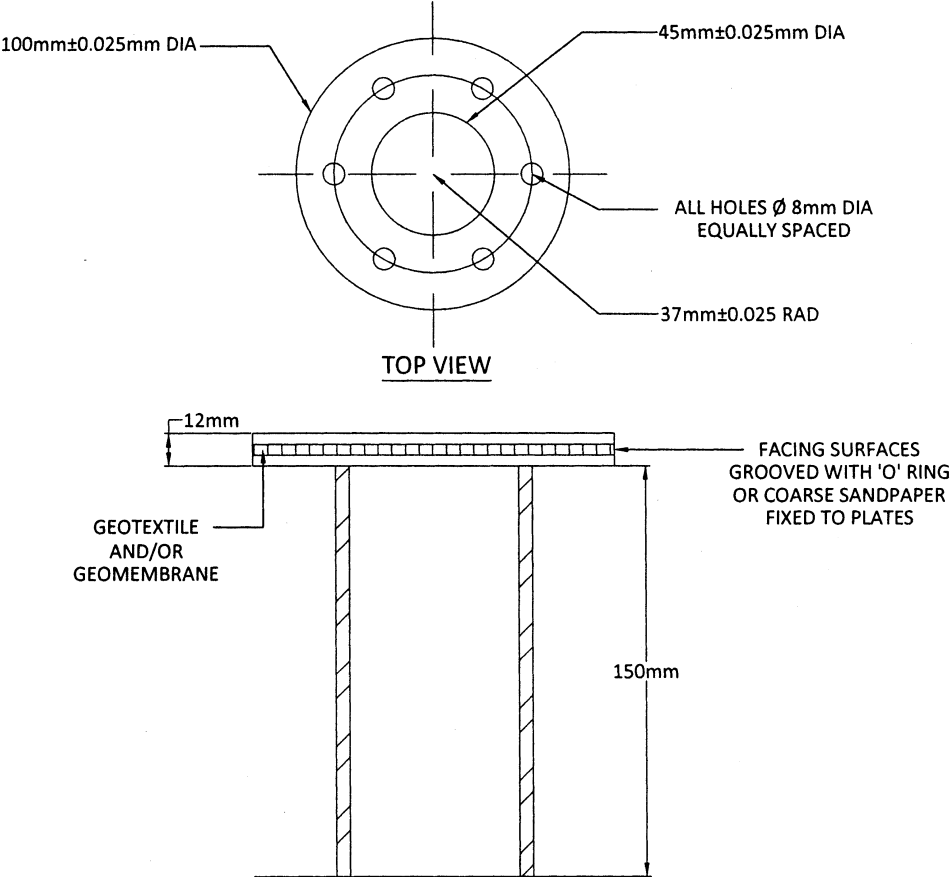


FIG. 1 TEST FIXTURE DETAIL (NOT TO SCALE)

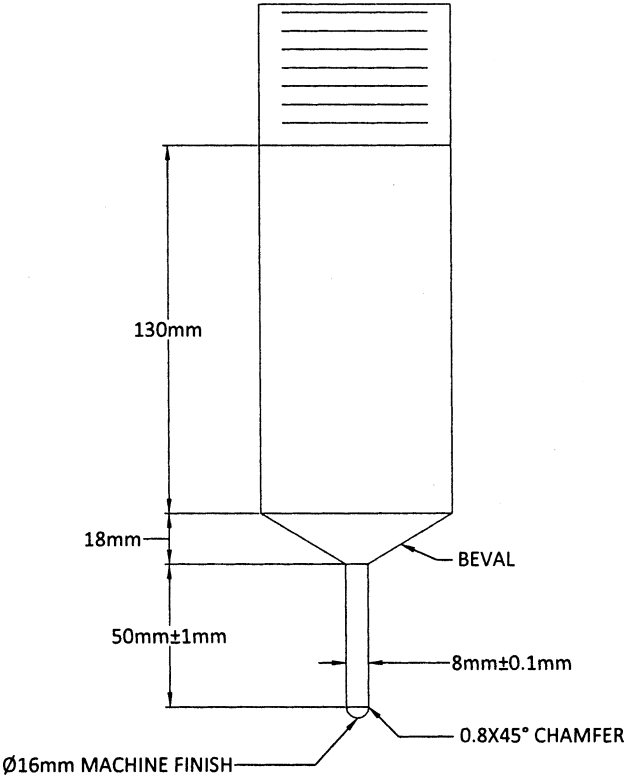


FIG. 2 TEST PROBE DETAIL (NOT TO SCALE)

using cutting die or by scissor for mechanical apparatus.

**7.2** Cut circular or rectangular specimen of a size sufficient to fit in a pneumatic apparatus.

## 8 TEST CONDITION

Bring the specimens to moisture equilibrium in the atmosphere for testing as specified in **3.1**. Equilibrium is considered to have been reached when the increase in the mass of the specimen, in successive weightings made at interval of not less than 2 h, does not exceed 0.1 percent of the mass of the specimen (*see* also IS 6359).

## 9 PROCEDURE

**9.1** Select the load range of the tensile/compression testing machine such that the rupture occurs between 10 and 90 percent of the full-scale load.

**9.2** Center and secure the specimen between the holding plates ensuring that the test specimen extends to or beyond the outer edges of the clamping plates.

**9.3** Test at a machine speed of  $300 \pm 10$  mm/min until the puncture rod completely ruptures the test specimen.

**9.4** Read the puncture resistance from the greatest

force registered on the recording instrument during the test. For the testing of composite geomembrane materials, there may be a double peak. If so, the initial value shall be reported even if the second peak is higher than the first one.

## 10 CALCULATION

Calculate the average puncture resistance and standard deviation for all tests as read directly from the recording instrument.

## 11 REPORT

The report shall include the following:

**11.1** Description of test apparatus.

**11.1.1** The method of holding the test specimen in the clamping device (mechanical or pneumatic).

**11.2** Test conditions.

**11.3** Any deviations from standard procedure.

**11.4** Identification and description of geosynthetic sample(s).

**11.5** The average puncture resistance of the specimens tested.

## ANNEX A

### (Foreword)

#### COMMITTEE COMPOSITION

##### Geosynthetics Sectional Committee, TX 30

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| The Synthetics & Art Silk Mills Research Association, Mumbai                 | DR MANISHA MATHUR<br>SHRIMATI ASHWINI Sudam ( <i>Alternate</i> )            |

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This Indian Standard has been developed from Doc No.: TXD 30 (1123).

### Amendments Issued Since Publication

| Amend No. | Date of Issue | Text Affected |
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